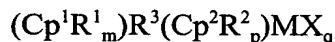


CLAIMS

What is claimed is:

1 1. A poly(α -olefin) copolymer obtained from the polymerization of at least one
2 α -olefin having from 2 to about 20 carbon atoms and at least one bulky olefin, the process
3 comprising polymerizing the monomers in the presence of hydrogen and a catalytically
4 effective amount of a catalyst comprising the product obtained by combining a metallocene
5 procatalyst with a cocatalyst, the metallocene procatalyst being at least one compound of
6 general formula:

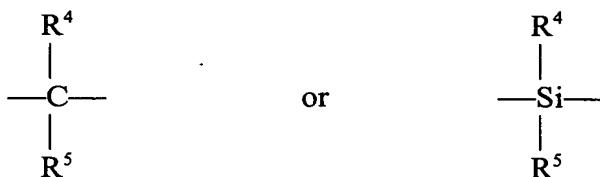


7 wherein Cp^1 of ligand $(Cp^1R^1_m)$ and Cp^2 of ligand $(Cp^2R^2_p)$ are the same or different
8 cyclopentadienyl rings, R^1 and R^2 each is, independently, hydrogen or a hydrocarbyl,
9 halocarbyl, hydrocarbyl-substituted organometalloid or halocarbyl-substituted
10 organometalloid group containing up to about 20 carbon atoms, m is 0 to 5, p is 0 to 5 and
11 two R^1 and/or R^2 substituents on adjacent carbon atoms of the cyclopentadienyl ring
12 associated therewith can be joined together to form a ring fused to the cyclopentadienyl ring,
13 the fused ring containing from 4 to about 20 carbon atoms, R^3 is a bridging group bridging
14 Cp^1 and Cp^2 , M is a transition metal having a valence of from 3 to 6, each X is a non-
15 cyclopentadienyl ligand and is, independently, halogen or a hydrocarbyl, oxyhydrocarbyl,
16 halocarbyl, hydrocarbyl-substituted organometalloid, oxyhydrocarbyl-substituted
17 organometalloid or halocarbyl-substituted organometalloid group containing up to about 20
18 carbon atoms, q is equal to the valence of M minus 2, the cocatalyst being an aluminoxane
20 and it being provided that ligand $(Cp^1R^1_m)$ is different from ligand $(Cp^2R^2_p)$ and bridging

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1 group R³ contains at least two bulky groups.

1 2. The poly(α -olefin) of claim 1 wherein in the metallocene procatalyst, bridging
2 group R^3 possesses the structure



12 in which groups R⁴ and R⁵ each, independently, is, or contains, a cyclic group of from 6 to
13 about 20 carbon atoms, from 0 to 3 heteroatoms and hydrogen as the remaining atoms.

1 3. The poly(α -olefin) of claim 2 wherein in the metallocene procatalyst, the
2 cyclic group is a cycloalkyl, heterocycloalkyl, cycloalkenyl, heterocycloalkenyl, aryl,
3 heteroaryl, alkaryl, alkylheteroaryl, aralkyl or heteroaralkyl group.

1 4. The poly(α -olefin) of Claim 3 wherein in the metallocene procatalyst, ligand
2 ($Cp^1R_m^1$) is unsubstituted cyclopentadienyl, ligand ($Cp^2R_p^2$) is substituted or unsubstituted
3 indenyl or fluorenyl, M^1 is zirconium, R^4 and R^5 each is phenyl and each ligand X is chlorine.

1 5. The poly(α -olefin) of Claim 1 wherein the metallocene procatalyst is
2 combined with hydrogen and the cocatalyst in any order thereof in the presence or absence of

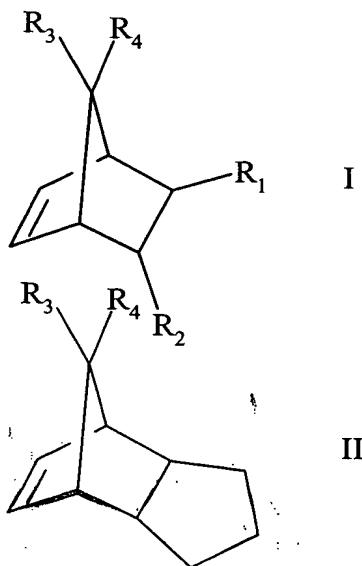
3 monomer.

1 6. The poly(α -olefin) of claim 2 wherein the metallocene procatalyst is combined
2 with hydrogen and the cocatalyst in any order thereof in the presence or absence of monomer.

1 7. The poly(α -olefin) of claim 3 wherein the metallocene procatalyst is combined
2 with hydrogen and the cocatalyst in any order thereof in the presence or absence of monomer.

1 8. The poly(α -olefin) of claim 4 wherein the metallocene procatalyst is combined
2 with hydrogen and the cocatalyst in any order thereof in the presence or absence of monomer.

1 9. The poly(α -olefin) of claim 1 wherein the bulky olefin is selected from the
2 group consisting of cyclic and polycyclic olefins of the structural formulae:



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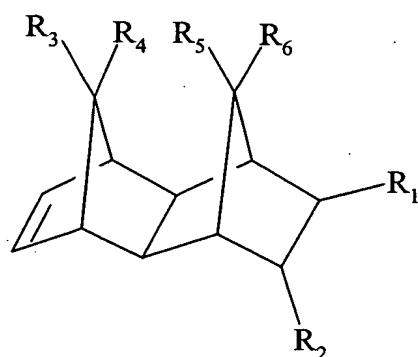
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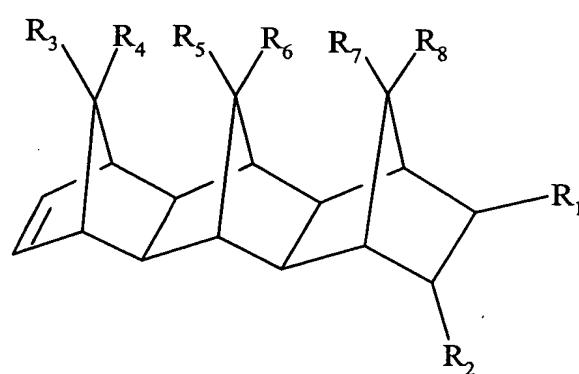
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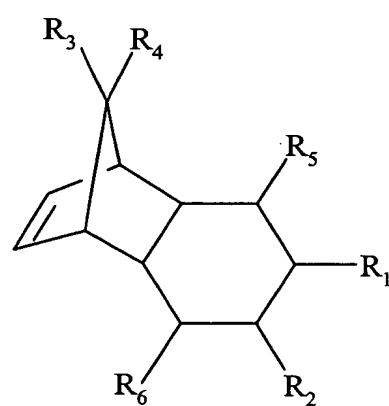
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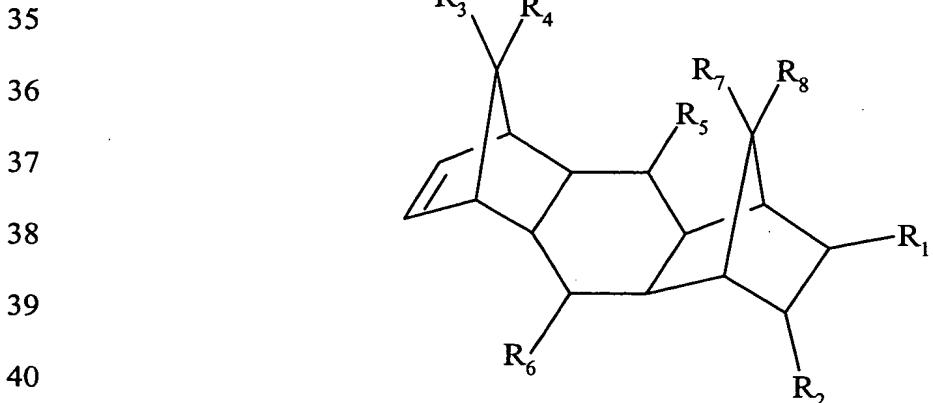


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43 wherein R₁, R₂, R₃, R₄, R₅, R₆, R₇, and R₈ are identical or different and are selected from the
44 group consisting of hydrogen, C₆-C₁₆ aryl moieties, and C₁-C₈ alkyl moieties, it being possible
45 for identical radicals in the different formulae to have different meanings.

1 10. The poly(α -olefin) of claim 1 wherein the α -olefin is 1-decene and the bulky
2 olefin is norbornene.

1 11. The poly(α -olefin) of claim 1 wherein polymerization is carried out under
2 solution polymerization conditions.

1 12. The poly(α -olefin) of claim 1 wherein polymerization is carried out under
2 slurry polymerization conditions.

1 13. The poly(α -olefin) of claim 1 possessing a M_w of from about 500 to about
2 80,000, a M_w/M_n of from about 1.0 to about 10, a Kv_{100} of from about 10 to about 10,000, an
3 Iodine Number of from about 0.0 to about 10 and a T_g of below about -20° C and wherein the
4 poly(α -olefin) is substantially amorphous.

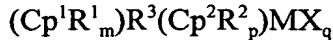
1 14. The poly(α -olefin) of claim 13 possessing a M_w of from about 750 to about
2 60,000, a M_w/M_n of from about 1.5 to about 5, a Kv_{100} of from about 20 to about 7,500, an
3 Iodine Number of from about 0.1 to about 5 and a T_g of below about -30° C and wherein the
4 polyalphaolefin is substantially amorphous.

1 15. The poly(α -olefin) of claim 14 possessing a M_w of from about 1,000 to about
2 40,000, a M_w/M_n of from about 1.75 to about 4, a Kv_{100} of from about 25 to about 5,000, an
3 Iodine Number of from about 0.2 to about 3 and a T_g of below about -40° C and wherein the
4 poly(α -olefin) is substantially amorphous.

1 16. A lubricant composition comprising a lubricant and a viscosity-modifying
2 amount of a poly(α -olefin) copolymer obtained from the polymerization of at least one α -
3 olefin having from 2 to about 20 carbon atoms and at least one bulky olefin, the process
4 comprising polymerizing the monomers in the presence of hydrogen and a catalytically
5 effective amount of a catalyst comprising the product obtained by combining a metallocene

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6 procatalyst with a cocatalyst, the metallocene procatalyst being at least one compound of
7 general formula:



9 wherein Cp^1 of ligand $(Cp^1R^1_m)$ and Cp^2 of ligand $(Cp^2R^2_p)$ are the same or different
10 cyclopentadienyl rings, R^1 and R^2 each is, independently, hydrogen or a hydrocarbyl,
11 halocarbyl, hydrocarbyl-substituted organometalloid or halocarbyl-substituted
12 organometalloid group containing up to about 20 carbon atoms, m is 0 to 5, p is 0 to 5 and
13 two R^1 and/or R^2 substituents on adjacent carbon atoms of the cyclopentadienyl ring
14 associated therewith can be joined together to form a ring fused to the cyclopentadienyl ring,
15 the fused ring containing from 4 to about 20 carbon atoms, R^3 is a bridging group bridging
16 Cp^1 and Cp^2 , M is a transition metal having a valence of from 3 to 6, each X is a non-
17 cyclopentadienyl ligand and is, independently, halogen or a hydrocarbyl, oxyhydrocarbyl,
18 halocarbyl, hydrocarbyl-substituted organometalloid, oxyhydrocarbyl-substituted
19 organometalloid or halocarbyl-substituted organometalloid group containing up to about 20
20 carbon atoms, q is equal to the valence of M minus 2, the cocatalyst being an aluminoxane
21 and it being provided that ligand $(Cp^1R^1_m)$ is different from ligand $(Cp^2R^2_p)$ and bridging
22 group R^3 contains at least two bulky groups.

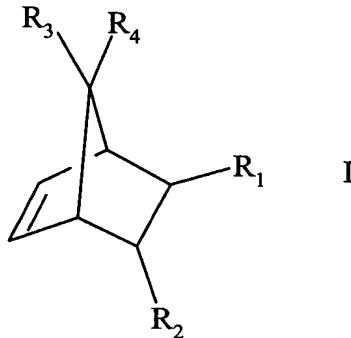
1 17. The lubricant composition of claim 16 wherein in the metallocene procatalyst,
2 ligand $(Cp^1R^1_m)$ is unsubstituted cyclopentadienyl, ligand $(Cp^2R^2_p)$ is substituted or
3 unsubstituted indenyl or fluorenyl, M^1 is zirconium, R^4 and R^5 each is phenyl and each ligand

4 X is chlorine.

1 18. The lubricant composition of claim 16 wherein the bulky olefin is selected
2 from the group consisting of cyclic and polycyclic olefins of the structural formulae:

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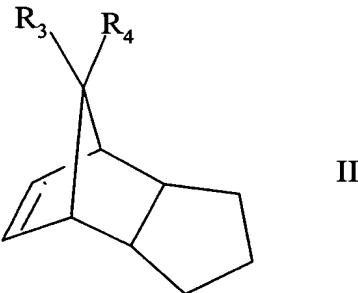
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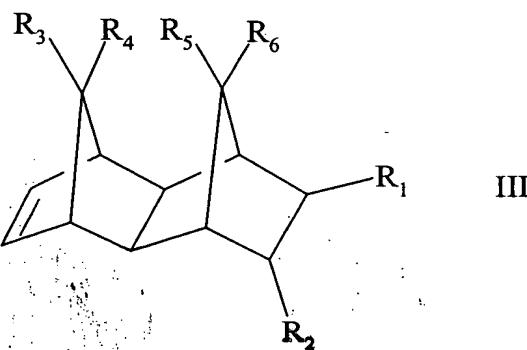
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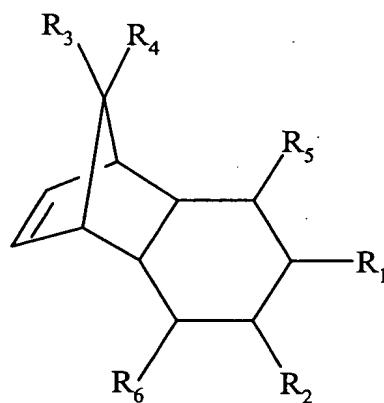
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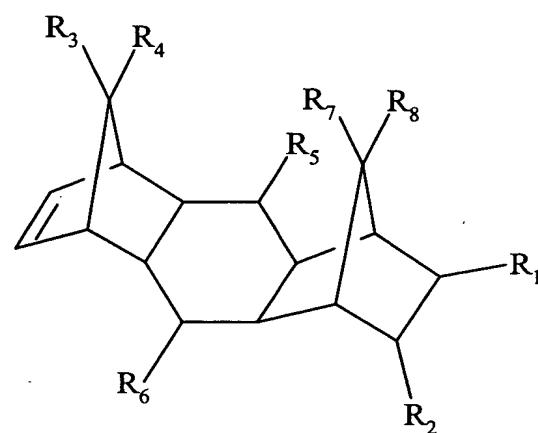
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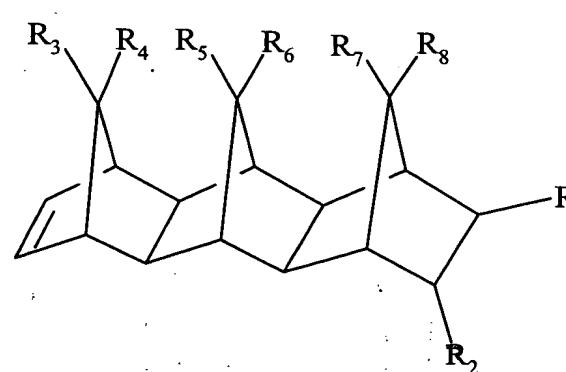
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41 wherein R₁, R₂, R₃, R₄, R₅, R₆, R₇, and R₈ are identical or different and are selected from the
42 group consisting of hydrogen, C₆-C₁₆ aryl moieties, and C₁-C₈ alkyl moieties, it being possible
43 for identical radicals in the different formulae to have different meanings.

1 19. The lubricant composition of claim 16 wherein the α -olefin is 1-decene and
2 the bulky olefin is norbornene.

1 20. The lubricant composition of claim 16 wherein polymerization is carried out
2 under slurry polymerization conditions.

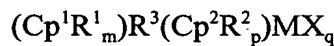
1 21. The lubricant composition of claim 16 wherein the poly(α -olefin) possesses a
2 M_w of from about 500 to about 80,000, a M_w/M_n of from about 1.0 to about 10, a Kv₁₀₀ of
3 from about 10 to about 10,000, an Iodine Number of from about 0.0 to about 10 and a T_g of
4 below about -20° C and wherein the poly(α -olefin) is substantially amorphous.

1 22. The lubricant composition of claim 16 wherein the poly(α -olefin) possesses a
2 M_w of from about 750 to about 60,000, a M_w/M_n of from about 1.5 to about 5, a Kv₁₀₀ of from
3 about 20 to about 7,500, an Iodine Number of from about 0.1 to about 5 and a T_g of below
4 about -30° C and wherein the poly(α -olefin) is substantially amorphous.

1 23. A method for improving the viscosity index of a lubricant composition

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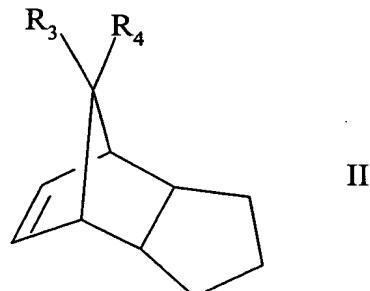
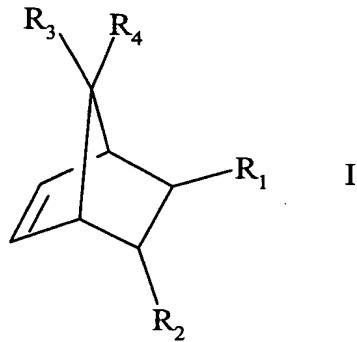
2 comprising adding to the composition a viscosity-modifying amount of a poly(α -olefin)
3 copolymer obtained from the polymerization of at least one α -olefin having from 2 to about
4 20 carbon atoms and at least one bulky olefin, the process comprising polymerizing the
5 monomers in the presence of hydrogen and a catalytically effective amount of a catalyst
6 comprising the product obtained by combining a metallocene procatalyst with a cocatalyst,
7 the metallocene procatalyst being at least one compound of general formula:



9 wherein Cp^1 of ligand $(Cp^1R^1_m)$ and Cp^2 of ligand $(Cp^2R^2_p)$ are the same or different
10 cyclopentadienyl rings, R^1 and R^2 each is, independently, hydrogen or a hydrocarbyl,
11 halocarbyl, hydrocarbyl-substituted organometalloid or halocarbyl-substituted
12 organometalloid group containing up to about 20 carbon atoms, m is 0 to 5, p is 0 to 5 and
13 two R^1 and/or R^2 substituents on adjacent carbon atoms of the cyclopentadienyl ring
14 associated therewith can be joined together to form a ring fused to the cyclopentadienyl ring,
15 the fused ring containing from 4 to about 20 carbon atoms, R^3 is a bridging group bridging
16 Cp^1 and Cp^2 , M is a transition metal having a valence of from 3 to 6, each X is a non-
17 cyclopentadienyl ligand and is, independently, halogen or a hydrocarbyl, oxyhydrocarbyl,
18 halocarbyl, hydrocarbyl-substituted organometalloid, oxyhydrocarbyl-substituted
19 organometalloid or halocarbyl-substituted organometalloid group containing up to about 20
20 carbon atoms, q is equal to the valence of M minus 2, the cocatalyst being an aluminoxane
21 and it being provided that ligand $(Cp^1R^1_m)$ is different from ligand $(Cp^2R^2_p)$ and bridging
22 group R^3 contains at least two bulky groups.

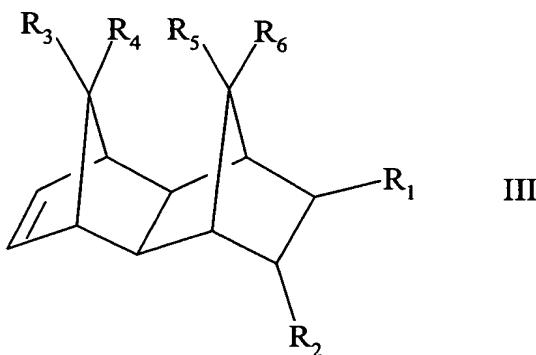
1 24. The method of claim 23 wherein in the metallocene procatalyst, ligand
2 (Cp¹R_m¹) is unsubstituted cyclopentadienyl, ligand (Cp²R_p²) is substituted or unsubstituted
3 indenyl or fluorenyl, M¹ is zirconium, R⁴ and R⁵ each is phenyl and each ligand X is chlorine.

1 25. The method of claim 23 wherein the bulky olefin is selected from the group
2 consisting of cyclic and polycyclic olefins of the structural formulae:

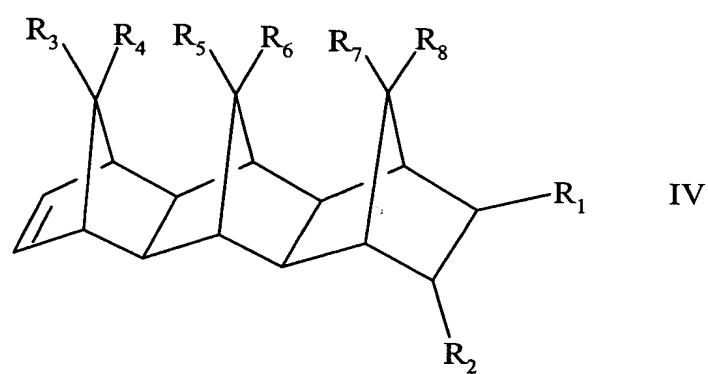


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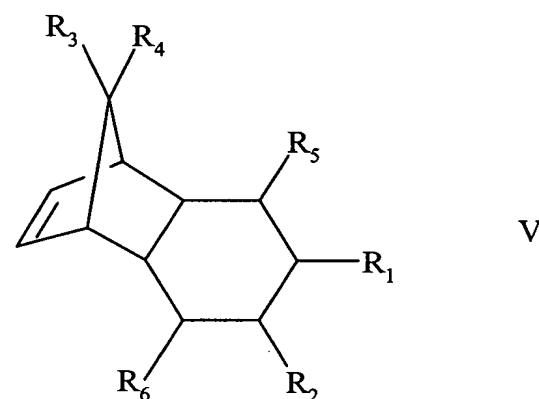
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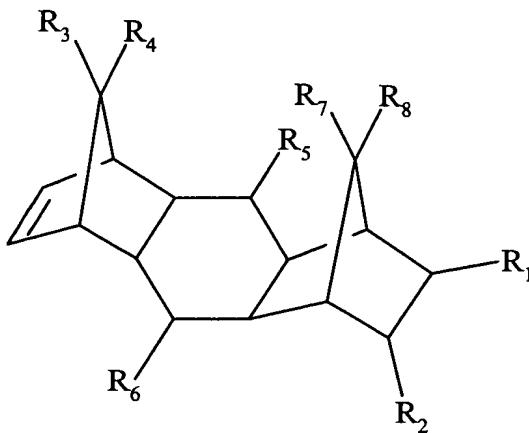
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wherein R₁, R₂, R₃, R₄, R₅, R₆, R₇, and R₈ are identical or different and are selected from the group consisting of hydrogen, C₆-C₁₆ aryl moieties, and C₁-C₈ alkyl moieties, it being possible for identical radicals in the different formulae to have different meanings.

1 26. The method of claim 23 wherein the α -olefin is 1-decene and the bulky olefin
2 is norbornene.

1 27. The method of claim 23 wherein polymerization is carried out under slurry
2 polymerization conditions.

1 28. The method of claim 23 wherein the poly(α -olefin) possesses a M_w of from
2 about 500 to about 80,000, a M_w/M_n of from about 1.0 to about 10, a K_{V₁₀₀} of from about 10
3 to about 10,000, an Iodine Number of from about 0.0 to about 10 and a T_g of below about -

4 20° C and wherein the poly(α -olefin) is substantially amorphous.

1 29. The method of claim 23 wherein the poly(α -olefin) possesses a M_w of from
2 about 750 to about 60,000, a M_w/M_n of from about 1.5 to about 5, a Kv_{100} of from about 20 to
3 about 7,500, an Iodine Number of from about 0.1 to about 5 and a T_g of below about -30° C
4 and wherein the polyalphaolefin is substantially amorphous.